AMRAD NEWSLETTER

Amateur Radio Research and Development Corporation

February 1982

OUR FEBRUARY 1 MEETING will be a discussion of spread spectrum led by Hal Feinstein, WB3KDU, Secretary of the AMRAD Spread Spectrum Special Interest Group (SSSig). This is preparatory to our written report to the FCC detailing our spread spectrum experimentation and to our filing of comments in response to the FCC Notice of Inquiry and Proposed Rule Making, General Docket No. 81-414, which appeared in the November 1981 issue of the newsletter.

PLANNED FOR THE MARCH 1 MEETING is a tutorial session on internetwork (internet) protocols, particularly the NBS version. At this writing, the NBS Internet Protocol is a possible candidate for that to be used in the Amateur Radio Computer Network - AMNET.

FLEMINGTON, NJ is the site for a special January 23 meeting on packet network addressing and routing schemes. K8MMO, W4RI, WB4JFI, and WB5MMB are attending from the Washington, DC area. Steve Robinson, W2FPY has done a remarkable job lining up various groups and individuals in the NJ-NY-CT area who are interested in setting up 220-MHz packet repeaters. They will eventually be linked up into an East-Coast packet repeater chain extending from Norfolk, VA to Montreal, PQ, with a leg east to Boston, MA. Look for some words on this meeting in next month's "Protocol" column by Dave Borden, K8MMO.

THIS ISSUE WAS COMPUTER GENERATED, after a struggle getting the system up and running. Most of the problems with the Diablo Hy-Type I printer mentioned in the last issue have been cured. It's working nearly 100% now, but it could use some mechanical fine tuning by someone with factory training. The impetus for making the system/printer work or else came when the IBM Selectric typewriter gave out and the repairperson couldn't come because of the snow. That happened right in the middle of preparing QEX for printing. Dave Borden's columns in both QEX and this newsletter were sent over the phone lines using Ward Christensen's MODEM7, edited using WordStar and printed on the Diablo.

THE VIENNA WINTERFEST '82 will be held on Sunday, February 28 at the Vienna, VA Community Center. AMRAD will have two tables, one of which is available to members who have only one or two items to sell. We will need members to take turns populating the tables throughout the hamfest. So, when you have looked around, c'mon over and give someone a break.

"PACKET SWITCHING: Tomorrow's Communications Today," is a new book by Roy D. Rosner which is priced at $34.00 from Lifetime Learning Publications, 10 Davis Dr, Belmont, CA 94002, order no. (41K5000).

TELEX AND TWX VIA AN APPLE COMPUTER is offered under the name Micro-Telegram by Microcom, Inc., 89 State Street, Boston, MA, 02109, 617-367-6362.

WESTERN UNION ACCEPTS TELEGRAMS VIA TDDs (deaf TTYs) according to an ad in GA-SK NEWSLETTER, published by Telecommunications for the Deaf, Inc. According to the ad, you can send up to $1,000 and charge it to a popular credit card, or originate telegrams, candygrams and even singing telegrams. The toll-free number is TTY-800-325-1101 (in Missouri, TTY-800-329-1474.

"INTERFACING TO S-100/IEEE 696 MICRO-COMPUTERS, by Sol Libes and Mark Garetz, is available for $15.00 from Osborne/McGraw-Hill, Berkeley, CA.

LOOKING FOR A NORTHERN VIRGINIA QTH? If you are, you should be aware of a newsletter, called Home QTH, which is prepared by Carolyn Wilson, a realtor and wife of K4YF. This service specializes in locating good sites for radio amateurs. You can reach her by writing 3824 Woodrow St N, Arlington, VA 22207 or calling 703-790-1500 (work) or 703-533-1783 (home).

AN S-100 DTMF TRANSCEIVER BOARD is available from MK Enterprises, 8911 Norwick Rd, P.O. Box 29654, Richmond, VA 23229, telephone 804-740-8380. It is the MK-II and sells for $425.00. You may have seen this item at the Richmond, VA "Frostfest."

Federal Communications Commission
Gettysburg, PA 17325

In Reply Refer To
December 24, 1981 7130

Paul L. Rinaldo
1524 Springvale Ave.
McLean, VA 22101

Dear Mr. Rinaldo:

This is in response to your recent request to extend the operating authority authorized under Special Temporary Authority granted on March 6, 1981 to include spread spectrum operation and experiments in the amateur two meter band.

Authority is granted to permit spectrum operation in direct accordance with the provisions previously granted subject to the following additional special conditions.

1. Two meter operations may not cause harmful interference to licensed users in the two meter amateur radio spectrum.

2. This authority is extended only to the amateur radio stations W4RI, N4EZV and WB3KDU.

3. Operation is limited to the Annapolis, Maryland/Washington, D.C. area at a power level not to exceed 25 watts except for limited testing at the 150 watt level.

4. Operations are limited to the frequency range 144-148 MHz.

This Special Temporary Authority will expire with the previous authorization granted March 6, 1981 through March 6, 1982.

Sincerely,

Richard H. Everett

Richard H. Everett
Chief, Licensing Division

Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	)	
	)	PR Docket No. 81-699
Use of Additional Digital Codes	)	RM-3788
in the Amateur Radio Service.	)	

COMMENTS

The Amateur Radio Research and Development Corp. (AMRAD), an experimenters' radio and computer club of over 500 members, fully supports the need for additional digital codes as petitioned by the American Radio Relay League (ARRL).

We endorse the Commission's proposed rulemaking except in the following particulars:

1. The highest permissible ASCII sending speed and bandwidth should be raised to 56 kilobits per second and 100 kHz respectively in the 220.5 to 221.9 MHz subband to permit packet switching network operations in that subband. The Commission's asertion that bandwidths over 16 kHz would interfere with existing operations is not applicable to this subband which is relatively underutilized. To have the proposed limitations of 19.6 kbps and 16 kHz would unnecessarily impede the orderly development of packet switching.

2. The proposed change from specifying signaling speed in bauds to bits per second, in our opinion, would discourage experimentation. It is generally accepted that the term "baud" describes the manifest signaling rate, whereas "bits per second" places a further limitation by specifying the actual information rate. The effect of changing to "bits per second" would be to remove the incentive for amateurs to experiment with m-ary modulation systems such as quadinary phase-shift keying (QPSK) which uses less bandwidth than binary phase-shift keying (BPSK) for the same information rate.

Respectfully submitted,

January 12, 1982

Paul L. Rinaldo, W4RI
President, Amateur Radio Research
and Development Corp. (AMRAD)
1524 Springvale Avenue
McLean, Virginia 22101

0&11 FCC
cc ARRL

PROTOCOL

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Sterling, VA 22170
703-450-5284 (Metro No.)

PACKET NEWS

The AMRAD packet radio repeater is down for a short time. The receiver received, in addition to packet users, the RFI from the TNC board which desensed it. The transmitter was only 25 watts and not heard over a very wide area. The RFI problem will be solved by shielding and the power problem with an 80-watt amplifier.

Hank Magnuski, KA6M, reports the formation of a new group to further the interests of packet radio in the Bay Area of San Francisco. It is called the Pacific Packet Radio Society and the first general meeting will be in late February.

Jim, KA6ETJ, reports connecting an Apple microcomputer to the TNC board. This might at first seem a trivial task, unless you have studied the Apple serial interface situation. Jim used the Mountain Computer CPS Multifunction card running at 9600 baud. He had to write a machine language driver that bypassed the CPS firmware and communicated directly with the 2651 PCI. Other problems encountered were the reset message of TIP-M03 (no handshake on this message) and lower-case conversion required as the Apple does not handle lower case. Jim is now working to connect the program to the Apple screen editor (Apple Pie). This code will be available for other Apple users to enable saving to disk for later printing.

Terry Fox, WB4JFI, is continuing work on the AMRAD S-100 Station Node Controller board. Testing is coming along well and software development has begun in 8080 assembly language.

The remainder of the column this month is devoted to the latest news from our desert packeteer, Den Connors, KD2S.

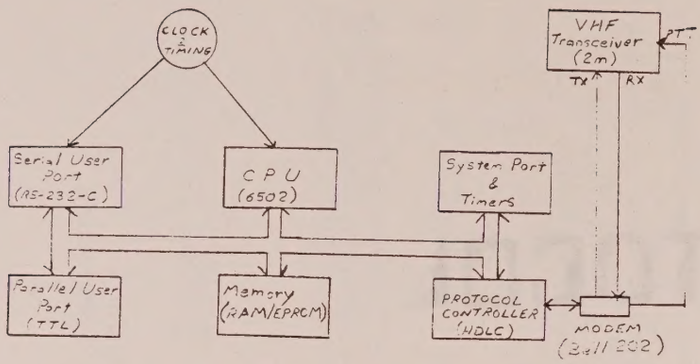
Southern Arizona has begun the creation of a multi-function amateur packet radio system, with special emphasis on modem design, experimentation with the three major types of packet physical protocols and gateway designs and configurations. The group has designed a terminal node controller with integral modem and power supply, and is currently designing some original experiments with carrier sense multiple access local area protocols.

The Tucson Amateur Packet Radio group (TAPR) was conceived on October 29, 1981, following a meeting of the Tucson chapter of the IEEE Computer Society, and the first meeting of TAPR occurred in November. At that meeting were Den Connors, KD2S; Dave McLain, N7AIG; Jerry Clark, K7KZ; Lyle Johnson, WA7GXD; Mark Baker; and Mark Chamberlan, WA7PXW.

The group continued to add members, so that by the second group meeting on December 5th, the ranks included eighteen members from Tucson, Phoenix and other towns in Southern Arizona. At that meeting, a temporary slate of officers and chairpeople was elected/coerced, and an initial implementation schedule was chosen.

The figure shows the basic block diagram of the TAPR terminal node controller (TNC). The group believes it to be the first TNC designed and constructed entirely in the United States, the first to have an integral Bell 202-equivalent modem built in, and the first to include all electronics, including most of the power supply, on a single board. This compact design will allow the entire package to be acquired for around $150, far less than other packet TNC/modem/power supply combinations seen to date. It is hoped that TAPR and AMRAD will be able to use this system to accelerate the growth of packet radio on the amateur bands.

The TNC has an architecture based on 6500/6800-series microprocessor hardware, with Exar modulator/demodulator ICs. A 6502 CPU and 6522 port/timer form the control section, with 4016 static RAM and 2716 EPROM as the system memory chips. The user has the option of interfacing to a terminal or personal computer through either a serial (6551 UART) or parallel (6520 PIA) port. The micro interfaces to the transceiver through the WD1933 HDLC protocol IC and the Exar 2206/2211 modem chip set. The hardware is rounded out with low-power Schottky digital ICs for



TAPR Terminal Node Controller

clocking, buffering and level translation, and with on-board regulators, diodes and capacitors for power. Only transformers, switches, connectors and the 5-volt capacitor/regulator/heat-sink need be installed off board.

The group is currently laying out the board, with a target of a two-sided, 4 x 8 in. (approx), plated-through board. Twenty-five boards will be created for initial evaluation. The circuits shown have already been tested on prototype development systems.

The protocol group met on December 11, and chose an initial packet architecture, under the constraints of full HDLC compatibility and allowance for expansion necessary for protocol evaluation, linking (routing) and gating to regional and national networks. Two bytes will be used for initial addressing, with the first byte containing the address of the source, and the second byte the recipient. Special i-d's in the first byte also indicate when a station first signs on, giving him a binary i-d, or that the user wants to broadcast a message to all users. The second byte includes a bit indicating a desire to be included in a sub-group on the simplex frequency, and an optional third byte would contain flags for up to seven separate groups that the user could be checked into. An optional fourth address byte allows linking into a particular task at the target station (printer, special link, community bulletin board, etc.), and a possible fifth address would select a link to other digipeaters or networks, such as AMSAT's AMICON, ground links (TERRACON), OR AMRAD's hf linking system (SKIPCON).

The TAPR protocol would also include two control bytes, the first for general use and the second dedicated to control stations, allowing on-frequency monitoring, control and digipeater program modification (up-loading). "Dumb" users may also use control codes for getting the latest copy of the operating protocol (down-loading).

The TAPR group will be releasing a version of the hardware and software (on EPROM) after initial tests of the system in January and February. The hardware plans call for a three-part kit: the pc board will come with IC sockets and discrete components wave-soldered, the ICs will be in a separate bag, and an inexpensive mini-cabinet with off-board discrete components included as a third piece. The wave-soldering is very important for system reliability, and the sockets will allow easy modification of the software memory chips as groups decide to update or experiment.

The software group is writing all routines, but the hardware drivers in the FORTH language and print-outs of the software will be available as developed. The drivers will be written in 6502 assembler and FORTH. After the system is operational, a FORTH program will be written to duplicate the 8086 assembler/PASCAL coding that defines the AMRAD packet protocol, so that the TNC may be used in local area nets talking the San Francisco lingo.

For further information, please feel free to contact any of the temporary officers or respective chairmen of the club. The current set of executive officers line up as follows;

President	Den Connors KD2S	602-744-9306
V Pres.	Lyle Johnson WA7GXD	602-889-8303
Secretary	Mark Baker (pending)	602-742-5118
Treasurer	Jerry Clark K7KZ	602-749-5785

Chairmen:

Local Area Net	Lyle Johnson WA7GXD
	Dave McClain N7AIG
Linking	Mark Chamberlin WA7PXW
Legal	Bob Buchanan WA7CCC
Public Relations	Den Connors, KD2S

The Tucson Amateur Packet Radio group is currently discussing formal affiliation with AMRAD, and the majority of our members will be joint members by early new year. Please watch this newsletter for updates on progress, descriptions of current protocols and experiments, and ordering information. We hope to hear packets from AMRAD members on both OSCAR 10 and the hf bands in 1982, so keep on experimenting with those digits.

73's from the TAPR group.

PROCEEDINGS OF THE OCTOBER 1981 ARRL packet conference are still available from AMRAD, 1524 Springvale Ave, McLean, VA 22101 for $5.00 payable to AMRAD. We will immediately mail out Volume 1 with the earlier papers, then mail Volume 2 as soon as possible with the later papers. There are two papers which we have been waiting for, but it looks like we'll have to just go to press with what we have. Any papers which do not make it by press time will be printed in another publication, probably the AMRAD Newsletter or QEX. If you're interested in amateur packet radio, you'll find these proceedings to be essential for your technical library.

W9JD FEC ARQ System
Measured Coding Scheme Noise Performance

Jerome T. Dijak, W9JD
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In response to my first few articles, Patrick LeBail, F3HK in Neuilly, France suggested that I do some measurements of the error rate versus signal-to-noise performance of the coding scheme that I am using. I thought that was a good idea, and last month I performed these tests. This article summarizes those results.

TEST CONDITIONS

Typically, when someone is testing the signal-to-noise performance of a modem, they use a steady source of white noise which is mixed in with an ideal data signal. The error rate produced by the modem is then noted at several ratios of signal-to-noise level. This is a very nice procedure for comparing the laboratory performance of various modems, but does not directly model the real (hf) world and requires a white-noise generator.

Therefore, I used a slightly different procedure to obtain a noise source. Since I am primarily interested in the type of noise that comes out of an hf receiver, why not use that to run the test? We would like the noise source to be as steady as possible, consistent with typical hf conditions, and we would like to be able to run many different test runs under identical noise conditions. These criteria were met by choosing an unused hf frequency just below the 20-meter amateur band, setting the passband filters of the Drake R-4 receiver for 400-Hz bandwidth and tuning it just as I would for reception of a 170-Hz-shift fsk signal, and then preparing a tape recording of the noise so obtained on a TEAC A-4300SK audio recorder. (The noise was recorded at 1800 EST on 7 Dec 81, and the band seemed fairly "typical" at that time.) The actual level of the noise was varying up and down as it usually does, and there was a fair amount of impulse noise (short, high-amplitude bursts) as there usually is.

For each test run, the test would be started at the same index counter point on the tape so that each run would experience very close to identical noise throughout the run - except perhaps for average level. Different runs would be made at different average signal-to-noise ratios. To adjust the level of the noise, the VU meters on the TEAC were used. And the levels were set over the same 10-second segment of the noise recording for each run - to preserve the relative levels between runs when the signal-to-noise ratio was being varied.

Fig. 1 shows the test set-up used to conduct the experiments. The band-limited test noise was amplified by a (hi-fi) power amp and then passed through a 5-ohm isolation resistor to the summer. The data signal, obtained from another recorder, was passed through its own isolation resistor and combined with the noise signal. An audio VTVM remained connected at all times to the summer circuit and was used to set or check levels. This composite signal was then sent to the demodulator and the software decoder.

My homebrew demodulator uses four-pole active filters (Butterworth) for each fsk channel (1275 and 1445 Hz). The 3-dB bandwidth of each channel bandpass filter is 170 Hz.

Special software was developed to generate suitable test data blocks for these tests and to exercise and record the performance of the decoding software for each run. I generated 256 pseudo-random data blocks to be sent over the test channel - filling these with a Fibonacci series of 8-bit bytes for randomness. The "data" tape contained this series of 256 random blocks, with adequate spacing between them to allow time for the receive program to decode each block and then compute and display the statistics for each block. Each of these blocks had a unique block address so that the receiving program could determine, after decoding, whether or not the block had been received correctly by comparison with a copy of the true blocks in memory. In addition to computing the decoder statistics on each block (not discussed here), the receiving program also compiled cumulative statistics for the entire run which included the number of blocks corrected, the number of raw blocks received error free (prior to decoding), and the number of undetected bad blocks (blocks that the decoder thought were correct but which were really not).

FAIR COMPARISON

As I discussed in a previous AMRAD Newsletter article, I am using an interleaved Reed-Solomon code of block length 15. Each of my blocks consists of a block start flag, a block address byte, 7 bytes of "data" and 6 check symbols. To make quantitative comparisons of the performance of this scheme versus an "uncoded" system requires some choices. This is because I cannot directly determine the uncoded byte error rate performance of

the demodulator operating without the decoder (I do not own bit-error-rate test equipment). Therefore I am basing my comparisons on the following assumptions.

I assume that we are interested in comparing the performance of a system using block coding with minimal error-detection capability (no correction possible), to one using my Reed-Solomon (15,9) forward-error-correction scheme. I further assume that this minimal "uncoded" system would require a block-start flag, a block-address byte and two bytes for some type of checksum. Thus, our "uncoded" scheme would transmit 11 data bytes within a block of 15 (we are assuming equal block lengths for the two systems).

In conducting the tests, in addition to checking the blocks that are processed by the decoder, we will also examine the "raw" blocks (prior to any decoding) to see if they were received error free. Throughout, the performance criteria we are mainly interested in is "% error-free blocks." That is, out of the 256 blocks sent per run, what percentage were received error free with and without the decoder? We assume that in real life, both the "coded" and "uncoded" systems would be required to retransmit blocks not received correctly.

In these experiments, the only way that we can be sure of which block it was that was actually sent is to have the decoder correctly decode it -- then using the block address we can look up that particular block in the table and see if all bytes match. We can then compare this block to the "raw" block and decide if it was error free even without the decoder. Because we are interested in very low signal-to-noise ratios, where there are a lot of errors, we are basing our comparisons on only those blocks, of all those transmitted, that are successfully decoded by the decoder. We can do nothing with the others, so they are ignored and do not enter into any of the statistics, except in determining the undetected bad block rate at the end.

So in the plots that follow, the "coded" data points correspond to the % error-free blocks performance of the Reed-Solomon decoder with operating conditions as stated. The "uncoded" data points correspond to the percentage of "raw" blocks that were received error free (prior to decoding).

So far so good, but we are not being quite fair, because the coded system is transmitting only 7 data bytes per block while the hypothetical uncoded system is transmitting 11 data bytes per block. To be realistic about this we should "allow" the uncoded system to run at 7/11 of the data rate of the coded system for our comparisons - with a resulting increase in equivalent signal-to-noise ratio due to the longer bit periods and same noise level. (A fair comparison should run both systems at the same data throughput rate.) It is not feasible to actually do this in the test, but we can compensate by noting that a 7/11 change in data rate is equivalent to a 1.96 dB lower signal-to-noise ratio than that actually run.

In interpreting the plots, the "Coded" curves are the performance of the Reed-Solomon decoder handling 7 data bytes per block, the "Uncoded" curves are the performance of a hypothetical block-coded scheme using error detection only and handling 11 data bytes per block, and the "Uncoded, Adjusted" curves are the performance of a scheme using error detection only and handling 11 data bytes per block, but at a data rate reduced such that the long time system throughput (under ideal conditions) would be the same as for the "Coded" system handling 7 data bytes per block.

S/N RATIO TEST

The first test examined decoder performance under varying signal-to-noise ratio conditions. The results are plotted in Fig. 2.

After setting the data signal level to a reference point well within the dynamic range of the demodulator with no noise present, the data signal was stopped while the noise signal was adjusted to the same level as the data. This level was then used as the "Ø dB" reference point for the remainder of the test. Test runs were conducted at S/N ratios between Ø and 15 dB as shown.

This test was performed at 150 bps, 170-Hz shift, and with the decoder attempting to correct 3 errors per block at all times. Each point shows the percentage of blocks, per run, that were received error free.

At signal-to-noise ratios of 12 dB or better, both systems do very well, with 100 percent performance occurring at 15 dB S/N. At these high S/N ratios there is no advantage to using this (or any) forward-error-correction scheme.

At extremely low S/N ratios, say Ø - 2 dB, the coded system has a much higher success rate than the uncoded system. At 2 dB S/N, for example, the coded system is getting 27% of all blocks through on the first try, while the "Uncoded, Adjusted" system is getting only 9% through. At very poor signal-to-noise ratios, then, there is an advantage to using forward error correction.

Between 2 and 10 dB, we see a set of roughly parallel curves, where the "coded" system is showing consistently better performance than the "Uncoded, Adjusted" system. Because the curves are displaced the equivalent of about 1.2 dB, we can conclude that through this range of S/N ratios coding provides a 1.2-dB advantage.

Regarding overall performance of a

communications system using these various coding schemes, we can say the following: At S/N ratios of 12 dB or better, system throughput would be essentially the same for either coded or uncoded systems. At S/N ratios below 10 dB, while both schemes would "work," the coded scheme would consistently produce significantly better throughput. At S/N ratios less than 2 dB, the coded system would have a much higher throughput than the uncoded scheme.

DATA-RATE TEST

This experiment examined system performance at a fixed S/N ratio (about 3 dB) but at three different data rates. The data is plotted in Fig. 3. The decoder was again being operated in the 3-error-correcting mode.

From this data we can conclude that for a given error-free block percentage, the "Coded" scheme allows a higher data rate than does the "uncoded, Adjusted" scheme. For instance, to attain a 60% rate the "Uncoded, Adjusted" scheme would need to run at about 90 bps while the "coded" scheme could run at 150 bps for the same success rate. This difference represents a ratio of 1.7 (2.3 dB). The curves suggest that the magnitude of this advantage varies with particular operation point, because the curves are not parallel.

It is also interesting to notice from this data that if one is operating at a very low throughput rate (10% error-free blocks), overall throughput can be improved by reducing data signaling rate -- if you reduce data rate by one-half you will more than double your error-free block percentage. On the other hand, if one is already operating above the 60% error-free block rate, reduction in data rate will probably not significantly increase overall throughput as the error-free block percentage does not increase commensurately.

DECODER MODE TEST

Although the decoder has the capability to correct 3 errors per block, the bad block detection property of the decoder can be greatly enhanced by restricting the decoder to correcting 0, 1 or 2 errors rather than 3. The price for this enhanced error detection capability, of course, is reduced throughput. Fig. 4 shows how the error-free block percentage is affected by choosing various decoder modes, and the performance of the uncoded schemes.

UNDETECTED BAD BLOCK PERFORMANCE

One of the most important performance criteria of our coding scheme is the rate at which bad (garbled) blocks slip past the decoder undetected - an Undetected Bad Block or UBB. There is a finite probability that this will occur, and I have shown these figures in Table I, below, for the various Decoder Modes. A 9.15% UBB rate, for instance, means that under very severe channel conditions (lots of errors), for every 100 garbled blocks that are uncorrectable, 9.15 will appear to the decoder as "correct." These blocks may then cause serious problems to the data user who is depending upon the data to be fully accurate.

The software used to run these tests was designed to allow compilation of data to also show how many blocks accepted by the decoder at "corrected" still contained errors. This information, along with the total number of uncorrectable blocks received, allowed computation of the observed UBB rate. The results shown in Table I represent the performance over all data runs, and the number of uncorrectable blocks considered in determining the rates are also shown. Note that to obtain truly reliable numbers for the observed UBB rates at Decoder Modes 02, 01, and 00 many many more runs would be required - and time was not available. These results are therefore less meaningful than those for Decoder Mode 03.

Table I
Decoder UBB Performance

Decoder Mode	Theoretical UBB Rate (%)	Observed UBB Rate (%)	Sample Size (Blocks)
03	9.15	0.88	908
02	0.14	0.0	381
01	0.0013	0.0	457
00	0.000000006	0.0	249

CONCLUSIONS

At signal-to-noise ratios greater than 12 dB, there is little advantage to using forward error correction over simple error detection - because almost all blocks are received error free anyway.

At signal-to-noise ratios less than 10 dB, forward error correction always allows a higher corrected block throughput, even after compensating for the difference in throughput due to the extra check symbols required to accomplish the forward correction.

The data suggest that to obtain a given percentage of error-free blocks through a channel, the coded scheme can operate with a 1.2 to 2.3 dB lower signal-to-noise ratio than the uncoded scheme - after allowing for the data throughput difference between the two systems.

The bottom line, then, becomes "is all this added system complexity worth 1.2 to 2.3 dB?" That, of course, depends upon the application. I suspect that in satellite work, and/or when there is simply no way to generate an extra 2 dB of signal power to make a radio link usable, then the coding gain is worth the complexity. If you can always be assured of 15 dB S/N ratios or better then don't bother with forward error correction.

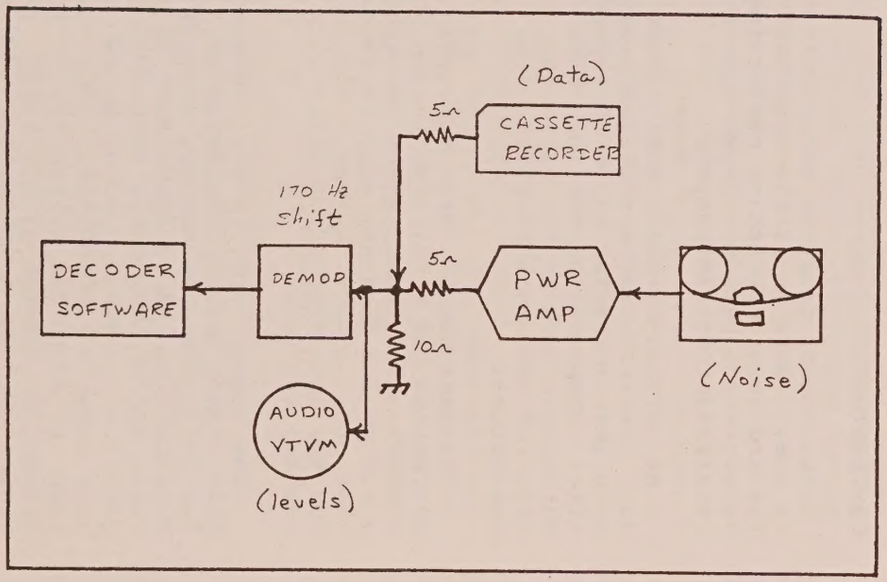

FIGURE 1. TEST SET UP

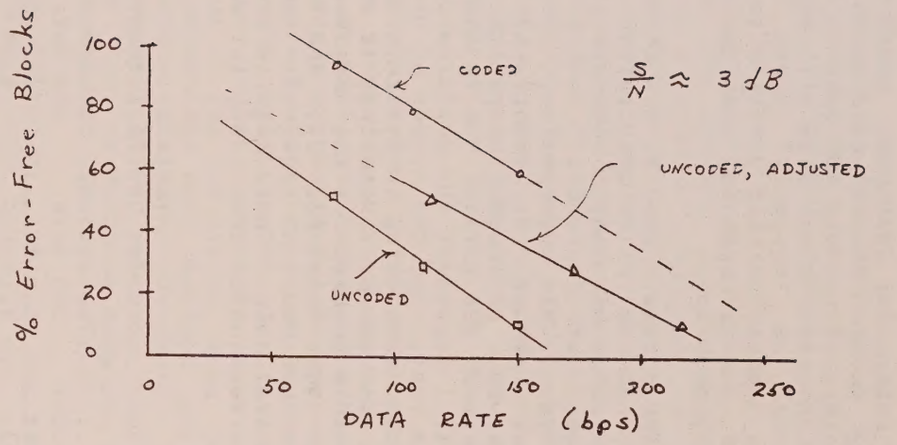

FIGURE 3. DATA RATE PERFORMANCE

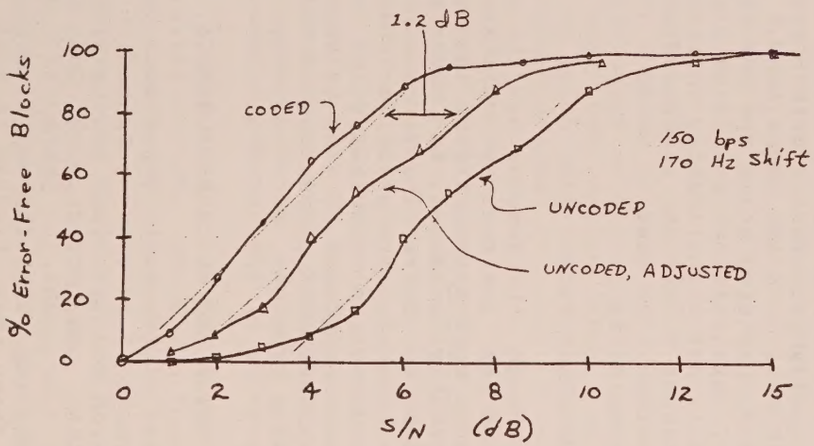

FIGURE 2. S/N PERFORMANCE

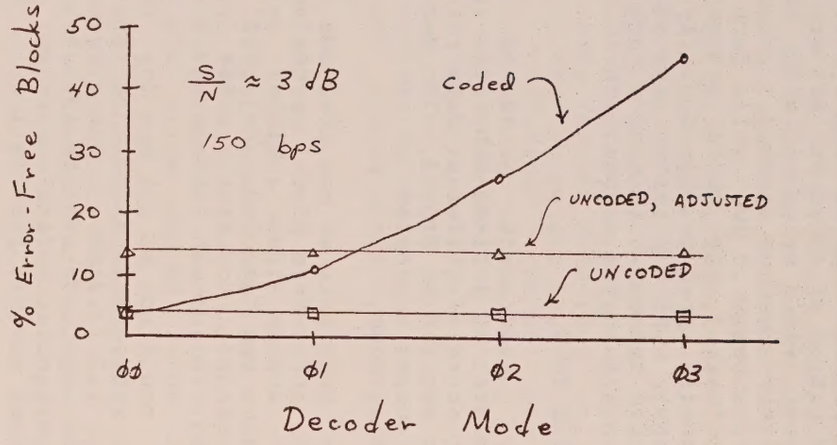

FIGURE 4. PERFORMANCE vs Decoder Mode

THE DEAF AND THE TTY

Barry Strassler
Executive Director
Telecommunications for the Deaf, Inc.
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Silver Spring, Maryland 20910
301-589-3006

OPEN REPLY TO A FRUSTRATED HOBBYIST

A computer hobbyist terminated the use of his computer as an electronic bulletin board for the deaf, citing adverse criticism and low usage. He expressed a sense of failure in his efforts.

I asked him if he had ever consulted deaf people and asked them for advice on making his system a viable one. He replied that, out of general message to all users of that system, feedback was elicited to the effect that mailbox privacy, accurate weather forecasts, informal and referral services, daily jokes, separate voice line services, and captioned broadcasting listings were all incorporated. Yet despite these efforts, usage of this electronic bulletin board was nil.

What went wrong? Competition from other electronic bulletin boards? Matter of approach? Lack of visibility? Lack of publicity?

Without getting into specifics, I would like to approach this issue from another perspective. The deaf community has only one common denominator -- the hearing impairment. Aside from this disability, the community is diverse. This is necessarily true for such area of New York City, Chicago, Los Angeles, as well as Washington, DC. In a typical community, there are subcultures -- a group of well-educated deaf trained in the oral method and unskilled in the use of manual signs, a group of well-educated deaf hailing from schools where use of signs is permitted, another of poorly educated oral deaf, and of poorly educated deaf using manual signs.

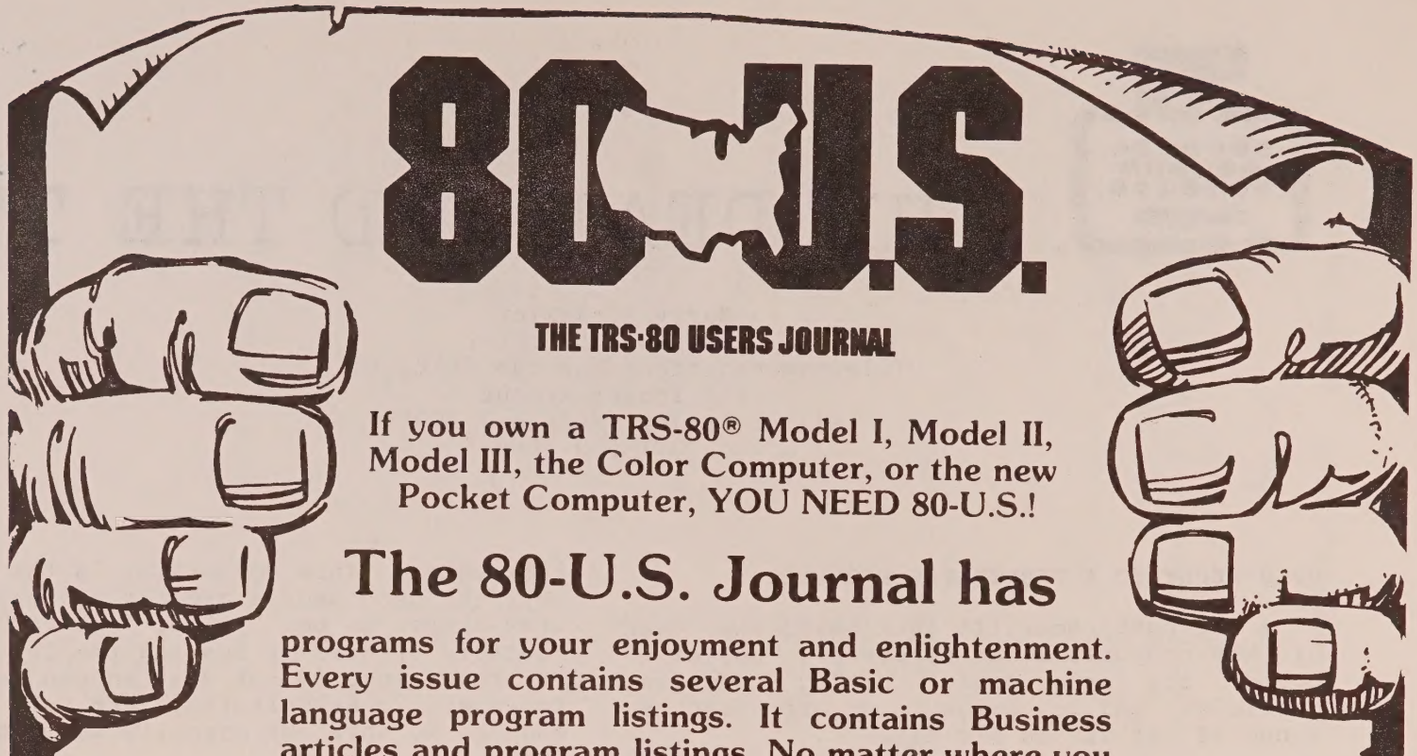
This adds up to four basic groups. This is not all. Then there are minority race deaf groups with their respective schooling and communication backgrounds. And still, another group of lonely deaf people whose lives have been spent with the non-deaf world. This latter group of people are not only unable to sign, but are also unable to lip read and can only communicate with manual deaf via pen and pad. There are leaders and organizations for each subculture, only looking after their own interests. This diversity is the reason why the deap people are not as "united" as they appear to be. Also, not to mention clusters of hard-of-hearing people, living on the fringe -- not deaf enough to belong to specific subcultures, and not hearing enough to interact normally with the non-deaf.

Statistics disclose that there are some half-million profoundly deaf people residing in this country. But diversity renders misleading these statistical numbers. There are, indeed, deaf people so isolated that they have never heard of TTYs, line 21 decoders, electronic bulletin boards, etc. A sad testimony to this diversity element is the disappointment expressed by Sears on the low sales of line 21 decoders.

Another matter is the issue of attitudes. Increased awareness of first-class citizenship rights have spurred a new breed of better informed deaf militants demanding implementation of HEW 504 regulations, provision of interpreters, open captioning of Federally funded TV programs and other privileges. This has brought on heightened resentment toward the non-deaf people who mean well in their efforts to help the deaf, but somehow whose behavior has been construed as condescending. These deaf militants are forever issuing challenges -- do they work with the deaf, rather than to work for the deaf? Do they decide what is the best for the deaf without consulting the deaf themselves first? If they are so interested in the deaf, why don't they master the language of signs?

I have only one piece of advice -- to consult leaders of each deaf subculture in person rather than to assume that what is best for a particular subculture is necessarily best for the rest of the deaf.

This is very important, lest efforts to develop better communications technology for the deaf -- TDDs, computers, electronic bulletin boards, TV decoders, radio systems -- would be declared technological successes but human factor failures!



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If interested in any of the above equipment, please contact:
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7946 Woodpecker Way
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BEACON FREQUENCIES PROPOSED by the FCC in PR Docket 81-823 are 28.08-28.10, 50.06-50.08, 144.05-144.06, 220.05-220.06, 222.05-222.06, and 432.07-432.08 MHz, using A0, A1, F0, or F1 emission. All Amateur frequencies above 450 MHz would also be permitted using any mode authorized for the particular frequency. Beacon power input would also be limited to 100 W, and identification would be required at intervals of one minute or less.

As Proposed, CW Identification would be either "W9JUV/BCN" or "W9JUV/B;" on phone the word "beacon" would have to follow the station callsign. Only one beacon would be permitted on each band from a given location, and though automatic control would be permitted measures would be required to insure the beacon's proper operation when no control operator was on duty.

Comments On PR Docket 81-823 will be due at the Commission March 15, and Reply Comments by April 15. Thanks HR Report.

"COMPUTERS AND THE RADIO AMATEUR" is a new 200-page book by W0XI that's both an introduction to computers and a discussion of how they can be applied to Amateur Radio. Included is a simple introduction to both assembly and BASIC computer languages. It's hardbound, sells for $18.95 plus $1 shipping from Ham Radio, Greenville, NH 03048. Thanks HR Report.

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THE AMATEUR RADIO RESEARCH AND DEVELOPMENT CORPORATION is a technically oriented club of over 500 radio and computer amateurs. It is incorporated in the Commonwealth of Virginia and is recognized by the Internal Revenue Service as a tax-exempt scientific and educational organization.

THE PURPOSES OF THE CLUB are to: develop skills and knowledge in radio and electronic technology; advocate design of experimental equipment and techniques; promote basic and applied research; organize forums and technical symposiums; collect and disseminate technical information; and, provide experimental repeaters.

MEETINGS ARE ON 1st MONDAY of each month at 7:30 p.m. at the Patrick Henry Branch Library, 101 Maple Ave E, Vienna, VA. If the 1st Monday is a holiday, an alternate date will be announced in the *AMRAD Newsletter*. Except for the annual meeting in December, meetings are normally reserved for technical talks - not business.

THE WD4IWG/R REPEATER is an open repeater for data communications (including RTTY), voice and experimental modes. It is located at Tyson's Corner, McLean, VA and has excellent coverage. It features a semi-private autopatch available to licensed members. Frequencies are: 147.81 MHz input, 147.21 MHz output. The head of the technical committee is Jeff Brennan, WB4WLW, 7817 Bristow Dr, Annandale, VA 22003, phone 703-354-8541.

THE AMRAD NEWSLETTER is mailed monthly to members and other clubs on an exchange basis. Technical articles, product announcements, news items, and other copy related to amateur radio and computing are welcom. Honorariums at a rate of $10 per printed page ($20 maximum per author per issue) are paid for original material accepted, Classified ads are free to members. Commercial ad inquiries are invited. The editor reserves the right to reject or edit any portions of the copy. Items should be mailed by the 8th of the preceeding month to Paul L. Rinaldo, W4RI, Editor, 1524 Springvale Ave., McLean, VA 22101, 703-356-8918. Full permission for reprinting or quoting items in the newsletter is granted provided that credit is given to both the author and the newsletter. Mailing to U.S. and possessions is by 3rd Class bulk mail. Canadian/Mexican addresses add $2 for postage. Overseas readers add $8 for air mail or $2.30 for surface.

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THE HANDICAPPED EDUCATION EXCHANGE (HEX) is operated by AMRAD for those involved in education and communications for the handicapped. It accepts both 110/300-baud ASCII and deaf TTY callers. on 301-593-7033. The sysop Dick Barth, W3HWN's home phone is 301-681-7372.

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SPECIAL INTEREST GROUPS are formed as needed. Currently we have SIGs on Deaf Telecommunications, Spread Spectrum and Packet Radio. If you are interested in joining or forming a SIG, please contact Bill Pala, WB4NFB, 5829 Parakeet Dr, Burke, VA 22015, 703-323-8345.

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